GROUNDWATER INFORMATION SHEET

Dibromochloropropane (DBCP)

The purpose of this groundwater information sheet is to provide general information regarding a specific constituent of concern (COC). The following information, compiled by the staff of the Groundwater Ambient Monitoring and Assessment (GAMA) Program, is pulled from a variety of sources and relates mainly to drinking water. For additional information, the reader is encouraged to consult the references cited at the end of the information sheet.

GENERAL INFORMATION	
Constituent of Concern	Dibromochloropropane (DBCP)
Synonyms	1,2-Dibromo-3-chloropropane, BBC 12, Fumagone, Fumazone, Nemabrom, Nemafume, Nemagone, Nemanax, Nemapaz, Nemaset, Nematocide, Nematox, Nemazone, OS1987, OxyDBCP , Gro-Tone Nematode, Durham Nematicide, OS 1897
Chemical Formula	$C_3H_5Br_2Cl$
CAS No.	96-12-08
Storet No.	38761
Summary	The California Department of Public Health (CDPH) regulates dibromochloropropane (DBCP) as a drinking water contaminant. The Maximum Contaminant Level (MCL) for DBCP is 0.2 µg/L. DBCP was used as a soil fumigant in the control of nematodes. The agricultural application of DBCP was banned in the continental United States in 1979. Very small quantities are still used as an intermediate in chemical synthesis. DBCP was first regulated in 1992. DBCP has been detected above the MCL in 220 active and standby public groundwater sources (of approximately 7673 sampled) since 1997. Most DBCP detections have occurred in Fresno, San Bernadino, and San Joaquin counties.

REGULATORY AND WATER QUALITY LEVELS[1] DBCP		
Type	**Agency**	**Concentration**
Federal MCL	US Environmental Protection Agency (US EPA)	0.2 µg/L
Federal MCLG[2]		Zero
State MCL	CDPH	0.2 µg/L
Detection Limit for Purposes of Reporting (DLR)		0.01 µg/L
Others: Public Health Goal (PHG) Tap Water Preliminary Remediation Goal (PRG)	 OEHHA US EPA, Region 9	 0.0017 µg/L 0.0047 µg/L

[1]These levels generally relate to drinking water. Other water quality levels may exist. For further information, see *Water Quality Goals* (Marshack, 2008).

[2]Maximum Contaminant Level Goal

SUMMARY OF DETECTIONS IN PUBLIC GROUNDWATER SOURCES[3]	
Number of active and standby public groundwater sources with DBCP[4] concentrations ≥ 0.2 µg/L	220 of approximately 7673 sampled
Top three counties with public groundwater sources[4] with DBCP concentrations ≥ 0.2 µg/L	Fresno, San Joaquin, San Bernardino

[3]Drinking water supplied from active and standby public groundwater sources is typically treated and/or blended so that tapwater does not exceed the MCL. Individual wells and small water systems not regulated by CDPH are not included.

[4]Based on CDPH data collected from 1994-2006 (GeoTracker).

ANALYTICAL INFORMATION		
Method	**Detection Limit**	**Note**
US EPA 504.1, 551.1	0.01 µg/L	CDPH approved for public drinking water systems
US EPA 524.1; 524.2	0.05 µg/L	
Known Limitations to Analytical Methods	Samples are preserved with sodium thiosulfate to avoid possible reactions between residual chlorine and contaminants present in some solvents. Potential for interference with impurities contained in extracting solvents. The US EPA recommends methods 504.1 and 551.1. DBCP can be misidentified as ethylene dibromide. Laboratory confirmation procedures outlined by the US EPA should be strictly adhered to.	
Public Drinking Water Testing Requirements	CDPH established an MCL of 0.2 µg/L for this pesticide in 1989, with associated requirements for quarterly monitoring, compliance determinations, and treatment. In 1992, the US EPA adopted an MCL of 0.2 µg/L and required monitoring for public water sources.	

DBCP OCCURRENCE	
Anthropogenic Sources	Prior to 1979, DBCP was primarily used as a soil fumigant for the control of nematodes in over 40 different crops in the United States. Today very small quantities of DBCP are manufactured only for the purpose of chemical synthesis of other compounds.
Natural Sources	DBCP is a manufactured chemical that does not occur naturally in the environment.
History of Occurrence	Data collected on workers involved in the manufacture and formulation of DBCP has shown that DBCP can cause sterility at very low levels of exposure. Agricultural application of DBCP was banned in the United States in 1979, with the exception of use in the Hawaiian pineapple industry. Use in the pineapple farming industry was banned in 1985. Today, DBCP is only used as a chemical intermediary in the manufacture of synthetic compounds. The total volume of DBCP manufactured for this purpose is believed to be very small. In California, DBCP was used extensively prior to 1979. DBCP was one of the most useful and simple to use nematicides. In 1977, 831,000 pounds of DBCP were used in California, primarily on grapes and tomatoes. DBCP has been detected in public groundwater sources in California, with the majority of occurrences in Fresno, San Joaquin, San Bernardino, Riverside, and Tulare counties.
Contaminant Transport Characteristics	DBCP dissolves in water, and may occur as a dense non-aqueous phase liquid. Its density is greater than the water; free phase DBCP may sink to the bottom of an aquifer where it can persist for long periods of time. The half-life of DBCP in an aquifer with a temperature of 15° C is estimated at 141 years. In the atmosphere DBCP is easily broken down by sunlight. DBCP is not likely to accumulate in aquatic life.

REMEDIATION & TREATMENT TECHNOLOGIES

The removal of DBCP from water can be accomplished through different methodologies, including air-stripping and filtration using granulated activated carbon. DBCP can also be removed using hydrogen peroxide combined with a catalyst (Fenton's Reagent). Ozone is a strong oxidant that can react with and oxidize DBCP to carbon dioxide and water. Zero-valent iron (FeO) is frequently used *in situ* to remove DBCP in passive remediation systems. In the simplest application of this technology, a permeable reactive barrier or iron wall is installed by digging a trench perpendicular to the direction of groundwater flow and back-filling it with iron. Water that passes through the zero-valent iron barrier is stripped of DBCP.

Wastewater treatment plants often use chemical oxidizers like potassium permanganate and biodegradation processes to remove chlorinated hydrocarbons from water. However, the effect of these techniques on DBCP is not documented. The US EPA approved treatment method for the removal of DBCP in drinking water is to use granulated activated carbon with packed tower aeration.

HEALTH EFFECT INFORMATION

Ingestion of DBCP results in gastrointestinal distress and pulmonary edema. The likelihood of exposure to DBCP through food sources is extremely low since DBCP rapidly volatilizes when exposed to air and sunlight. Additional exposure pathways are through inhalation and direct contact.

Acute inhalation exposure to DBCP in humans results in moderate depression of the central nervous system, kidney and liver damage, and pulmonary congestion. Dermal exposure may irritate the skin and eyes in humans and animals. Even low exposure to DBCP by humans may cause sterility in men or other male reproductive effects, such as decreased or no sperm counts. There is some evidence that DBCP may have the potential to cause cancer with lifetime exposure at levels above the MCL.

KEY REFERENCES

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7. Marshack, J.B. 2008. California Environmental Protection Agency/ Regional Water Quality Control Board, Central Valley Region. A Compilation of Water Quality Goals.

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FOR MORE INFORMATION, CONTACT: John Borkovich, SWRCB (916) 341-5779.